Manual on the Basic Set of Environment Statistics of the FDES 2013

Air Quality Statistics

Topic 1.3.1 of the Basic Set of Environment Statistics of the FDES 2013

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# 1. Statistics in topic 1.3.1 Air Quality

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## a. Local air quality
1. Concentration level of particulate matter (PM$_{10}$)  
2. Concentration level of particulate matter (PM$_{2.5}$)  
3. Concentration level of tropospheric ozone (O$_3$)  
4. Concentration level of carbon monoxide (CO)  
5. Concentration level of sulphur dioxide (SO$_2$)  
6. Concentration levels of nitrogen oxides (NO$_X$)  
7. Concentration levels of heavy metals  
8. Concentration levels of non-methane volatile organic compounds (NMVOCs)  
9. Concentration levels of dioxins  
10. Concentration levels of furans  
11. Concentration levels of other pollutants  
12. Number of days when maximum allowable levels were exceeded per year

## b. Global atmospheric concentrations of greenhouse gases
1. Global atmospheric concentration level of carbon dioxide (CO$_2$)  
2. Global atmospheric concentration level of methane (CH$_4$)
2. Introduction/Relevance

• This topic includes statistics on the ambient concentration of the most important air pollutants, including suspended solid particles, gases and other relevant pollutants that can have a negative effect on human and ecosystem health.
  – more than 2 million premature deaths attributable to the effects of urban air pollution and indoor air pollution occur every year (WHO).

• Air quality is measured at monitoring stations. Data availability varies according to the country’s circumstances.

• National monitoring of air quality is usually limited to urban settlements where polluting activities and the affected population are concentrated.

• This topic provides relevant information for public policy at national/subnational/local and international levels (air quality standards, SDG indicator, OECD GGI, etc.).
3. Definitions and description of the statistics

- General definitions:
  - Air quality
  - Local / Global
  - Concentration
  - Pollution
  - Pollutant:
    - Primary vs Secondary
    - Gaseous vs Particulate, Respirable
  - Scales: Urban, Regional, Hemispheric and global
  - Types of Source
3. Definitions and description of the statistics

- General definitions:
  - Impacts: population, environment
  - Human Exposure:
    - Source -> Emission -> Concentrations -> Exposure -> Dose -> Health effects
    - Microenvironments:
      - Indoor vs outdoor
      - Developed vs developing
      - Urban vs rural
    - Different population susceptibility: genetic, socioeconomic status, age, nutrition, gender, chronic diseases
  - Environmental equity
  - Criteria pollutants: PM, O3, CO, SOx, NOx, Pb
  - Standards:
    - Primary (population) and secondary (environment)
    - Latent and saturated areas
  - Health impact assessment
3. Definitions and description of the statistics

Health impact assessment

- Air pollution data
  - Modelled levels\(^a\)
  - (or monitored)
- Population risk
  - Overall
  - Susceptible groups
- Exposure estimate
- Concentration-response function(s)
- Background data
  - Mortality rates
  - Morbidity rates
- Impact estimate

\(^a\) If modelled data are used, the approach can be used to assess the impact of emission reduction strategies on different health outcomes.

Source: WHO
3. Definitions and description of the statistics
Costs of inaction of Air Pollution

Source: OECD (2016), The Economic Consequences of Outdoor Air Pollution
3. Definitions and description of the statistics

• Description of the statistics:
  
  – Sources for the definitions:
    • UNECE Standard Statistical Classification of Ambient Air Quality (1990).
    • European Environment Agency
    • USEPA Air Quality Planning and Standards.
    • World Meteorological Organization (WMO)
    • Agency for toxic substances and diseases (ATSDR)
    • The United Nations Environment Programme (UNEP)
    • Pan American Health Organization
    • Clean Air Institute
    • National Air Quality Legislations
  
  – Structure for each statistic:
    • General description
    • Statistical description
3. Definitions and description of the statistics

• Description of the statistics, example:

  1.3.1.a.1 Concentration level of particulate matter (PM10)

  • General description:

  – Particulate matter," also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

  – The size of particles is directly linked to their potential for causing health problems. Particles that are 10 micrometers in diameter or smaller generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects.

  – "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.

  • Statistical description:

  – PM10 measurements are reported as average concentrations of mobile 24-hour, daily and annual particulate in the air, expressed in micrograms on cubic meter to normal pressure and temperature μg/m3N. Normal temperature and pressure conditions is a standard that allows the comparison of the experimental measures between different sets of data measures. One of the most used standard is the temperature of 293,15 K and a pressure of 1 atm (National Institute of Standards and Technology, NIST).

  – WHO standards:

    » 20 μg/m3 annual mean
    » 50 μg/m3 24-hour mean
4. International sources and recommendations
4.A Classification and groupings

• Different classifications of air pollutants
  – Source of generation
  – Local/Global
  – Evolution in the atmosphere
  – Gaseous pollutants
  – Particulate matter
  – Criteria pollutants
  – Greenhouse effect
  – Ozone layer depletion
4. International sources and recommendations
4.B Reference to international statistical recommendations, frameworks and standards

- International sources:
  - European Environment Agency (environment statistics and indicators)
  - OECD (Air quality statistics and indicators, GGI)
  - USEPA Air Quality Planning and Standards.
  - World Meteorological Organization (WMO)
  - Agency for toxic substances and diseases (ATSDR)
  - The United Nations Environment Programme (UNEP)
  - Pan American Health Organization
  - Clean Air Institute
  - National Air Quality Legislations
4. International sources and recommendations
4.C Sources of global and regional environment statistics and indicators series

• Global and regional:
  – WHO
  – World Bank
  – UNSTAT
  – OECD
  – EUROSTAT
  – EEA
  – ECLAC
  – UNEP

• National:
  – Ministries of the Environment
  – NSOs
5. Transforming data into environment statistics
5.A Data collection and sources of data

• Source type: Monitoring Systems (Air quality monitoring stations) collect time series of pollutants, by hour, day, month, year.

• Institutional partners: Ministry of the Environment, Ministry of Health, Universities, Research Institutions, Private institutions, etc.

• Availability of data:
  – Determining the study objective: diagnosis
  – Design of a sampling plan:
    • Objectives, pollutants
    • Temporal and Spatial considerations
    • Representativeness of data

• Data quality: Data analysis, interpretation and review.
5. Transforming data into environment statistics
5.B Data compilation (procedures and instruments) and transformation into environment statistics series

• Data collection: Monitoring Systems (Air quality monitoring stations)

• Data validation:
  – correct errors in data due to maintenance of equipment, electrical faults or deviations in data without technical support.
  – Useful measures: number of data, central tendency (mean, median, mode), relative position (percentiles), dispersion (range, variance, standard deviation, coefficient of variation, interquartile range) and Association (correlation).
  – Graphics: time series, 2 scales, box.
5. Transforming data into environment statistics
5.B  Data compilation (procedures and instruments) and transformation into environment statistics series

• Transformation into statistics:
  – Process the time series to obtain moving averages, daily averages and annual averages, depending on the parameter that is being analyzed. To obtain a representative indicator it is necessary to have a minimum of data (f.e.: not less than 75% of the hourly data).
  – Moving averages are calculated taking the hourly data as many hours backwards needed the moving average.
  – Daily averages correspond to the average of the 24 hourly data recorded on the day.
  – The maximum daily corresponds to the maximum value recorded in the 24 hourly data of the day.
6. Uses and dissemination
6.A Potential presentation/dissemination formats

Source: Ministry of the Environment of Chile, www.sinia.cl
6. Uses and dissemination

6.A Potential presentation/dissemination formats

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**Daily PM2.5 and PM10 AQI Values in 2016**

*Chicago-Naperville-Elgin, IL-IN-WI*

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**Source:** U.S. EPA AirData <https://www.epa.gov/air-data>
6. Uses and dissemination
6.A Potential presentation/dissemination formats

Air Quality Health Index

Source: Environmental Protection Department of Hong Kong
6. Uses and dissemination
6.B Commonly used indicators that incorporate this statistic

- Concentrations of air pollutants: mean, percentile, maximum, etc
- Exceedence of air quality limit values (standard)
- Air Quality Index
- Population exposure to air pollution
- SDG Indicator: 11.6.2 - Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
- OECD Green Growth Indicators: Exposure to air pollution:
  - Mean population exposure to PM2.5 (Micrograms per cubic metre)
  - Percentage of population exposed to more than 10 micrograms/m³ (Percentage)
  - Percentage of population exposed to more than 35 micrograms/m³ (Percentage)
6. Uses and dissemination
6.C  SEEA accounts/tables that use this statistic

- The SEEA Central Framework doesn’t include air quality accounts (concentrations). But it includes emissions to the air (different FDES topic).
- The SEEA Experimental Ecosystem Accounting includes air filtration (clean air) and sequestering of carbon as ecosystem services.

Table 3.2 Physical flows of ecosystem services for an EAU

<table>
<thead>
<tr>
<th>Type of ecosystem services (by CICES)</th>
<th>Type of LCEU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forest tree cover</td>
</tr>
<tr>
<td>Provisioning services</td>
<td>e.g. tonnes of timber</td>
</tr>
<tr>
<td>Regulating services</td>
<td>e.g. tonnes of CO2 stored/released</td>
</tr>
<tr>
<td>Cultural services</td>
<td>e.g. number of visitors/likers</td>
</tr>
</tbody>
</table>

* Medium to large fields rainfed herbaceous cropland

Source: SEEA EEA 2012
Thank you
Gracias

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